⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　平2-142859

⑤Int. Cl.⁵　識別記号　庁内整理番号　㊸公開　平成2年(1990)5月31日

C 09 D 1/00　PCK A　6770-4J
PCN B　6770-4J
1/02　PCL　6770-4J

審査請求　未請求　請求項の数 1　(全5頁)

㊹発明の名称　無機塗料

㉑特　願　昭63-296919
㉒出　願　昭63(1988)11月24日

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PTO 2003-1919
S.T.I.C. Translations Branch

明　細　書

1．発明の名称

無機塗料

2．特許請求の範囲

第一燐酸カルシュウム、第一燐酸アルミニュウム、第一燐酸亜鉛等の燐酸を含んだ縮合物2～28重量部と、カオリン、シリカ、セリサイト、ベントナイト、タルク等の充填剤8～57重量部と、リチウムシリケートを主体としたバインダー70～100重量部と珪酸ナトリウム等の硬化促進剤10～30重量部及びアルミナゾル等のPH調整剤を混合してボールミル等により粉砕してPHが7．0～11．0の範囲内にある泥漿状としたことを特徴とする無機塗料。

3．発明の詳細な説明

（産業上の利用分野）

本発明は、耐候性、耐水性、耐熱性及び耐薬品性等の優れた効果を有する無機塗料に関するものである。

（従来の技術）

不燃建築材用外装板及び内装板又は鋼板、アルミニュウム板等の金属基材の表面を塗装する従来の無機塗料は、アンモニヤ水、酸化亜鉛、珪弗化ソーダ等の硬化剤と珪酸ナトリウム、珪酸塩ガラス等のアルカリ珪酸塩の結合剤と顔料を混合して構成されていた。

（発明が解決しようとする問題点）

前記の如く従来の無機塗料は、アルカリ珪酸塩を主成分とするため、エフロレックスを起こし易く耐候性が劣ると共に、硬化条件によっては、塗膜に亀裂や発泡が発生し、更に塗料に吸湿性があり、ゲル化し易く作業性を悪くする等の問題点があった。

（問題点を解決するための手段）

リケート（バインダー）７３ｇ、珪酸ナトリウム等の硬化促進剤３ｇ（いずれも重量比）を加えてボールミル等で約６０分間粉砕して得た泥漿物をそのＰＨが７．０～１１．０の範囲となるようアルミナゾル（ＰＨ調整剤）の適量を添加して無機塗料を構成し、該塗料を珪酸カルシュウム板（被塗装板）に塗装し、温度１８０℃で約２０分間乾燥して塗装板を作成した。この塗装板は外観が半透明な光沢約９％の艶消し仕上り状で、その性能は後記に示す。

（Ｂ）実施例２

純度８５％以上の燐酸２０ｇとアルミナ粉末４０ｇ、亜鉛華粉末４０ｇの重量比で混合して、酸化炎又は中性炎による９８０℃の雰囲気中で３時間程度焼成し、脱水して得た縮合燐酸塩粉末の重量比１８ｇにタルク２１ｇ、セリサイト７ｇ微珪石粉１３ｇ（いずれも充填材）を各重量比で混合した後、これを粒

度１～３ミクロンに微粉砕した充填剤微粉末と、バインダーとしてリチウム１００ｇ及び珪酸ナトリウム等の硬化促進剤９ｇ（いずれも重量比）を加え、ボールミルで約４５分間粉砕して泥漿物を得、これに適量のアルミナゾル（ＰＨ調整剤）を加えて泥漿物のＰＨを７．０～１１．０に調整して塗料を作成し、この塗料をフレキシブルボード（被塗装板）の表面に塗装して温度３００℃の雰囲気中で約４５分間乾燥して得た塗装板は光沢が約１８％あり、表面の平滑性も優れ、鉛筆硬度９Ｈの硬い被膜の塗装板が得られた。この塗装板の性能は後記に示す。

（Ｃ）実施例３

純度８５％以上の燐酸８０ｇアルミナ粉末１０ｇ、亜鉛華粉末１０ｇの重量比で混合して、酸化炎又は中性炎による焼成温度約６１０℃の雰囲気中で７時間程度焼成し、これにより脱水されて得た縮合燐酸塩粉末１８ｇ重

量比を取り出し、シリカ１４ｇ、タルク２１ｇ、セリサイト８０ｇ、ベントナイト１ｇ（いずれも充填材）の各重量比を混合して、これを１～８ミクロンに微粉砕した粉砕物にリチウムシリケート（バインダー）８０ｇ及び珪酸ナトリウム等の硬化促進剤４ｇ（いずれも重量比）を加えて、ボールミルで約３時間微粉砕して得た泥漿物に、適量のアルミナゾル（ＰＨ調整剤）を加えてＰＨが７．０～１１．０とした塗料を被塗装板に塗装して温度約２５０℃で３０分程度乾燥し、半透明な艶消しの塗装板を作成した。この塗装板の性能は後記に示す。

（Ｄ）実施例４

純度８５％以上の燐酸４０ｇアルミナ粉末１０ｇ、亜鉛華粉末１０ｇの重量比で混合し、酸化炎又は中性炎による焼成温度約９８０℃の雰囲気中で７時間程度焼成し、脱水した縮合燐酸塩粉末２３ｇ重量比を取り出し、こ

れにシリカ４１ｇ、ベントナイト７ｇ、セリサイト２ｇ、酸化チタン１０ｇ（いずれも充填剤）の各重量比を混合して、これを１～１０ミクロンに微粉砕した粉砕物に、リチウムシリケート（バインダー）８０ｇ及び珪酸ナトリウム等の硬化促進剤３ｇ（いずれも重量比）を加えて、ボールミルにより約２時間微粉砕した泥漿物に適量のアルミナゾル（ＰＨ調整剤）を加えて泥漿物のＰＨが７．０～１１．０にして得た塗料をフレキシブルボードの表面に塗装し、温度約１８０℃で２５分間程度乾燥して、白色の塗装板を作成した。この塗装板の性能は後記に示す。

手 続 補 正 書（自 発）

特願昭６３－２９６９１９号

上記特許出願に関し、明細書中誤記の個所がありましたので下記の如く訂正致します。

記

1. 明細書第２頁１２行目の

「エフロレックス」を「エフロレッセンス」と訂正する。

2. 明細書第３頁１４行目の

「タイル」を「タルク」と訂正する。

以 上

PTO 03-1919

CY=JA DATE=19900531 KIND=A
PN=02-142859

INORGANIC COATING MATERIAL
[Muki toryo]

Kazuya Yamada, et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. March 2003

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(10):	JP
DOCUMENT NUMBER	(11):	19900531
DOCUMENT KIND	(12):	A
PUBLICATION DATE	(43):	02142859
PUBLICATION DATE	(45):	
APPLICATION NUMBER	(21):	63296919
APPLICATION DATE	(22):	19881124
ADDITION TO	(61):	
INTERNATIONAL CLASSIFICATION	(51):	C09D 1/00; C09D 1/02
DOMESTIC CLASSIFICATION	(52):	
PRIORITY COUNTRY	(33):	
PRIORITY NUMBER	(31):	
PRIORITY DATE	(32):	
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TITLE	(54):	INORGANIC COATING MATERIAL
FOREIGN TITLE	[54A]:	MUKI TORYO

SPECIFICATIONS

1. Title of the Invention

Inorganic Coating Material

2. Claim

Inorganic coating material, characterized by mixing 2 to 28 parts by weight condensate containing phosphoric acid such as monobasic calcium phosphate, monobasic aluminum phosphate, or monobasic zinc phosphate, 8 to 57 parts by weight filler such as kaolin, silica, sericite, bentonite, or talc, 70 to 100 parts by weight binder based on lithium silicate, 10 to 30 parts by weight curing accelerator such as sodium silicate, and a pH regulator such as alumina sol, then crushing by a ball mill or the like to form a slurry within a range of pH 7.0 to 11.00.

3. Detailed Explanation of the Invention

[Industrial Field of Application]

This invention pertains to an inorganic coating material having excellent effects such as weathering resistance, water resistance, heat resistance, and chemical resistance.

[Prior Art]

Inorganic coating materials by prior art for coating the surface of nonflammable outer plating and inner plating for construction or metallic base materials such as steel plate or aluminum plate have been constituted by mixing a curing agent such as ammonia water, zinc

oxide, or sodium silicofluoride, an alkaline silicate binder such as silicate glass, and a pigment.

[Problems that the Invention is to Solve]

Because they have an alkali silicate as a major ingredient, inorganic coating materials by prior art such as described above have problems such as tending to cause efflorescence and having poor weather resistance, causing fissures or foaming in the film coat due to curing conditions, and having poor ease of operation due to the coating material absorbing moisture and tending to gel.

[Means of Solving the Problems]

This invention offers an inorganic coating material that solves the problems described above. Its details will be explained below.

The inorganic coating material of this invention is constituted by adding phosphoric acid converted to phosphorus pentoxide to a mixture of alumina powder (Al_2O_3) and zinc oxide powder (ZnO) in a 1:5 to 5:1 range of molar ratio at a mixture ratio of $P_2O_5:(Al_2O_3)+(ZnO)$ from 4:1 to 1:4, then calcining said paste mixture in a 600ºC to 1100ºC oxidizing flame or neutral flame baking atmosphere to form a dehydrated crystalline mixture and crushing this by a ball mill or the like until all pass through 200 mesh, combining 2 to 28 parts by weight said crushed condensate with 8 to 57 parts by weight filler such as kaolin, silica, sericite, bentonite, or talc, 70 to 100 parts by weight binder based on lithium silicate, and 10 to 30 parts by

weight sodium silicate solution as a curing accelerator, mixing and crushing this by a ball mill or the like to form a paste slurry, then adding alumina sol as a pH regulator to adjust the pH of said slurry to a range of pH 7.0 to 11.0.

Next, the operation and effects of this invention will be explained. When the surface of a coating object comprised of a nonflammable outer plating and inner plating for construction or a metallic base material such as steel plate or aluminum plate is coated by an inorganic coating material constituted as described above, then cured by heating to a temperature of 60°C to 300°C, a coated plate having a coating with excellent weathering resistance, water resistance, heat resistance, and chemical resistance can be obtained.

In this invention, a slurry comprised of a condensate, a filler, and a curing accelerator is adjusted to a range of pH 7.0 to 11.0 by adding a pH regulator using alumina sol because this range assures optimum ease of operation, storage, and physical properties of the film coat, and adding an alumina sol pH regulator achieves improved consistent coating hardness.

The reason why lithium silicate was selected for the binder of the coating material is because this forms a firm coating comparable to sodium silicate in coating coatability, and the coating obtained after drying is insoluble to water compared to silicates such as sodium silicate or potassium silicate. This effect is markedly

improved by subjecting to heat treatment.

The weatherproofing effect of lithium silicate also imparts excellent moisture resistance and wind resistance under all atmospheric conditions to the film coat obtained after drying compared to silicates such as sodium silicate or potassium silicate. Moreover, a coating material constituted as described above gains even more satisfactory coat curability when the condensate containing phosphoric acid has a 1:5 to 5:1 molar ratio of alumina powder to zinc oxide powder. This prevents developing fine fissures in the coating and improves weathering resistance, water resistance, and chemical resistance. Moreover, crushing the condensate and filler especially finely (for example, to 1 to 10 μm or less) can prevent efflorescence and increase glossiness.

An inorganic coating material according to this invention as described above forms a ceramic coated surface having excellent properties such as acid resistance, alkali resistance, water resistance, heat resistance, weathering resistance, and ease of operation, and produces a smooth coating with high hardness.

Furthermore, because this invention does not use any organic solvents, it has other excellent practical effects such as it is highly safe in terms of operation, does not produce organic gas from coating material in case of fire or the like, resists static charge, and does not produce any rust whatsoever.

[Working Examples]

(A) Working Example 1

An inorganic coating material was constituted by mixing 8 g kaolin, 4 g talc, and 23 g sericite (all fillers) by weight ratio with 20 g condensed phosphate powder by weight ratio obtained by mixing 40 g phosphoric acid of at least 85% purity, 5 g alumina powder, and 5 g zinc oxide powder by weight ratio and baking and dehydrating for approximately five hours in a 1050°C atmosphere produced by an oxidation flame or neutral flame, then pulverizing this to 1 to 6 μm, adding 73 g lithium silicate (binder) and 3 g curing accelerator such as sodium silicate (both by weight ratio) to this pulverized powder and crushing by a ball mill or the like for approximately 60 minutes to obtain a slurry, and adding a suitable amount of alumina sol (pH regulator) to adjust this slurry to a range of pH 7.0 to 11.0. A coated board was fabricated by coating said coating material onto a calcium silicate board (board to be coated) and drying at a temperature of 180°C for approximately 20 minutes. This coated board had a semitransparent flat finish with 9% glossiness in appearance, and the properties indicated below.

(B) Working Example 2

An inorganic coating material was constituted by mixing 21 g talc, 7 g sericite, and 13 g fine silica powder (all fillers) by weight ratio with 18 g condensed phosphate powder by weight ratio

obtained by mixing 20 g phosphoric acid of at least 85% purity, 40 g alumina powder, and 40 g zinc oxide powder by weight ratio and baking and dehydrating for about three hours in a 980°C atmosphere produced by an oxidation flame or neutral flame, then pulverizing this to 1 to 3 μm, adding 100 g lithium silicate as a binder and 9 g of a curing accelerator such as sodium silicate (both by weight ratio) to this pulverized filler powder and crushing by a ball mill or the like for approximately 45 minutes to obtain a slurry, and adding a suitable amount of alumina sol (pH regulator) to adjust this slurry to a range of pH 7.0 to 11.0. A coated board was fabricated by coating this coating material onto the surface of a flexible board (board to be coated) and drying in a 300°C temperature atmosphere for approximately 45 minutes. A coated board having a coating with approximately 18% glossiness, excellent surface smoothness, and 9H hard pencil hardness was obtained. The properties of this coated board are indicated below.

(C) Working Example 3

An inorganic coating material was constituted by mixing 14 g silica, 21 g talc, 80 g sericite, and 1 g bentonite (all fillers) by weight ratio with 18 g condensed phosphate powder by weight ratio obtained by mixing 80 g phosphoric acid of at least 85% purity, 10 g alumina powder, and 10 g zinc oxide powder by weight ratio and baking and thereby dehydrating for about seven hours in an approximately

610ºC baking temperature atmosphere produced by an oxidation flame or neutral flame, then pulverizing this to 1 to 8 μm, adding 80 g lithium silicate (binder) and 4 g curing accelerator such as sodium silicate (both by weight ratio) to this pulverized powder and crushing by a ball mill or the like for approximately 3 hours to obtain a slurry, and adding a suitable amount of alumina sol (pH regulator) to adjust this slurry to a range of pH 7.0 to 11.0. A semitransparent flat coated board was fabricated by coating this coating material onto the surface of a flexible board and drying at approximately 250ºC temperature for approximately 30 minutes. The properties of this coated board are indicated below.

(D) Working Example 4

An inorganic coating material was constituted by mixing 41 g silica, 7 g bentonite, 2 g sericite, and 10 g titanium oxide(all fillers) by weight ratio with 23 g condensed phosphate powder by weight ratio obtained by mixing 40 g phosphoric acid of at least 85% purity, 10 g alumina powder, and 10 g zinc oxide powder by weight ratio and baking and dehydrating for about seven hours in an approximately 980ºC baking temperature atmosphere produced by an oxidation flame or neutral flame, then pulverizing this to 1 to 10 μm, adding 80 g lithium silicate (binder) and 3 g curing accelerator such as sodium silicate (both by weight ratio) to this pulverized powder and crushing by a ball mill or the like for approximately two

hours to obtain a slurry, and adding a suitable amount of alumina sol (pH regulator) to adjust this slurry to a range of pH 7.0 to 11.0. A white coated board was fabricated by coating said coating material onto the surface of a flexible board and drying in an approximately 180ºC temperature atmosphere for approximately 25 minutes. The properties of this coated board are indicated below.

Table 1

	5% H_2SO_4 Solution (acid resistance 24 h spot test)	5% NaOH Solution (alkaline resistance 24 h spot test)
Working Example 1	no abnormalities	no abnormalities
Working Example 2	no abnormalities	no abnormalities
Working Example 3	no abnormalities	no abnormalities
Working Example 4	no abnormalities	no abnormalities
Commercial acrylic resin coating material (siding board coating material product)	discoloration	no abnormalities

Table 2

	Boiling Water Resistance (4 h x 2 cycles)	Water Resistance (for 30 days)
Working Example 1	no abnormalities	no abnormalities
Working Example 2	no abnormalities	no abnormalities
Working Example 3	no abnormalities	no abnormalities
Working Example 4	no abnormalities	no abnormalities
Commercial acrylic resin coating material (siding board coating material product)	swelling	no abnormalities

Table 3

	Weathering Resistance (Weathermeter 3000H)	Hardness (Mitsubishi pencil)
Working Example 1	no abnormalities	9H
Working Example 2	no abnormalities	9H
Working Example 3	no abnormalities	9H
Working Example 4	no abnormalities	9H
Commercial acrylic resin coating material (siding board coating material product)	loss of gloss	2H